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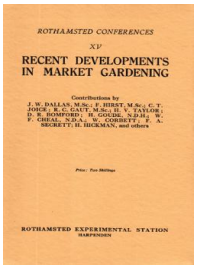
ROTHAMSTED RESEARCH

Recent Developments in Market Gardening

Full Table of Content



Xv. Recent Developments in Market Gardening

Lord Cornwallis

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ROTHAMSTED CONFERENCES

XV

RECENT DEVELOPMENTS IN MARKET GARDENING

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RECENT DEVELOPMENTS IN MARKET GARDENING

BEING THE REPORT OF A CONFERENCE HELD AT ROTHAMSTED ON DECEMBER 14TH, 1932, UNDER THE CHAIRMANSHIP OF

The Right Hon. LORD CORNWALLIS
C.B.E., T.D., J.P., D.L.

With Contributions by

J. W. DALLAS, M.Sc.; F. HIRST, M.Sc.; C. T. JOICE; R. C. GAUT, M.Sc.; H. V. TAYLOR; D. R. BOMFORD; H. GOUDE, N.D.H.; W. F. CHEAL, N.D.A.; W. CORBETT; F. A. SECRETT; H. HICKMAN, and others

ROTHAMSTED EXPERIMENTAL STATION
HARPENDEN

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CONTENTS

		PAGE
FOREWORD	Sir John Russell, D.Sc., F.R.S.	5
J. W. Dallas, M.Sc.	"The Market Gardening Industry: The Position in Bedfordshire" . . .	7
F. Hirst, M.Sc. .	"Canning of Fruit and Vegetables: What the Canner Wants" . . .	19
C. T. Joice . .	"Changing from Farming to Market Gardening"	26
R. C. Gaut, M.Sc. .	"Market Gardening in the Evesham District"	31
DISCUSSION— H. V. Taylor, D. R. Bomford, H. Goude, N.D.H., W. F. Cheal, N.D.A., W. Corbett, F. A. Secrett, H. Hickman, and others	. . . . .	36

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FOREWORD

By Sir E. John Russell

The prevailing distress in British agriculture is causing farmers to examine all kinds of other possibilities and naturally they are looking to see what chances there may be for market garden crops. They are attracted by the circumstance that the area under these crops continues to expand: the acreages under green peas, cabbages, Brussels sprouts, cauliflowers, beans picked green, celery and rhubarb in England and Wales having been greater in 1931 than in any previous year of which there is any record; carrots and onions however, slightly fell off. In 1932 there was an even further increase for all crops excepting Brussels sprouts and cabbages. The acreages are:

	England and Wales			
	1922	*Average of 9 years,* 1922-1930	1931	1932
Peas picked green	50,418	48,675*	57,445	60,800
Brussels sprouts	14,951	22,876	35,580	32,900
Cabbages (Human consumption)	27,954	26,784	35,702	33,900
Cauliflower and Broccoli	10,475	12,504	15,783	17,600
Beans picked green ..	12,684	12,782*	13,218	14,400
Carrots	14,084	9,935	9,430	12,500
Rhubarb	5,718	6,522	7,843	8,300
Celery	5,282	5,581	7,310	7,700
Onions	3,557	2,276	1,534	1,900

*1926-1930 only.

Figures for 1922 and 1932 kindly supplied by Mr. H. V. Taylor. Increase on acreage 1922 to 1932, 45,000 acres.

The agriculturist argues that he has had to reduce the areas under agricultural crops because he lost money over them: the market gardeners, on the other hand, have increased their acreages and must therefore have found their crops profitable.

There is the further consideration that demands for vegetables are increasing, and that recent fiscal changes have imposed duties on certain imported vegetables and fruits which give the English grower a sufficient degree of confidence to permit him to grow them. Mr. Dallas' paper shows how these various factors have reacted in Bedfordshire, one of the chief market garden areas in England, which was dealt with in detail because it can be regarded in many ways as typical.

Finally, the new industry of canning fruit and vegetables is now established and its success reveals the existence of a demand which needed only to be discovered in order to ensure its being satisfied. It opens up new hopes, for already an export demand has arisen from

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English people resident in the tropics who yearn for the taste of English fruits and vegetables. The canning industry has the great advantage for the grower that it enables him to work on a contract system so that he knows beforehand the price he will get and can adjust his procedure accordingly.

These crops would have had no interest to the farmer but for the fact that they are not necessarily restricted to market gardens. Some of them can quite well be grown on farms as alternatives to roots. Brussels sprouts, cabbages and cauliflowers have the advantage that the residues and any excess not saleable can be consumed on the farm : this problem was discussed at the Tenth Conference,* when enthusiastic accounts were given of the value of stalks of Brussels sprouts for stimulating the flow of milk in dairy cattle. Peas are already known to farmers as a grain crop : the cultivation of the crop for picking should not present insuperable difficulties. The practical problems of the change over from ordinary farm crops to market garden crops are discussed by Mr. Joice and others in the following pages, and methods are described by which in practise they have actually been overcome.

Farmers must not suppose, however, that the sowing of market garden crops is going to be a remedy for all their ills. Market gardeners have their own troubles, as the new entrant to the industry soon discovers. Swedes, turnips, kale and other crops grown for livestock are accepted without demur by the animals at the farm buildings. The vegetable market, however, is by no means unlimited ; it is very particular, even fastidious, and the buyer may refuse cabbages, sprouts and other vegetables for reasons which may appear wholly inadequate to the farmer who feels rather proud of them. Mr. Taylor's paper sets out the facts very concisely.

The requirements for the canning industry are only beginning to be known ; Mr. Hirst's statement will therefore be welcomed by growers.

Among the problems which are discussed in the following pages are the supply of suitable seed, the use of labour saving machinery for cultivation, the proper manuring of the crop, the crop diseases, especially the vague " sickness," and the ways of ensuring the best condition or quality for market. There still remains much need for experiments to discover more about these things, and there are other problems to work out, one of the most important being the best way of combining vegetable production with production of animals, such as poultry or pigs, so as to ensure economic utilisation of unsaleable material and some supplies of animal manure ; and these we hope will shortly be undertaken. But the greatest problem of all, which lies perhaps beyond the power of any body of mere men, is to persuade the lady in the kitchen to cook vegetables so that they can be eaten with pleasure and satisfaction. Who of us would have the courage to venture on this errand ?

*" The Growth of Cheaper Winter Food for Livestock " Report (2/6), obtainable from Rothamsted.

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THE MARKET GARDENING INDUSTRY: THE POSITION IN BEDFORDSHIRE

By J. W. DALLAS, M.Sc.
(County Agricultural Organiser)

BEDFORDSHIRE has an area of slightly over 300,000 acres of which at present approximately 250,000 acres are devoted to arable crops and grass. Grass accounts now for 50 per cent. of the latter acreage as some of the heavier arable land has been sown or tumbled down to grass. In the market gardening areas, however, the grassland does not exceed 25 per cent.

Crops

It is difficult to estimate the acreage occupied by market gardeners, as many of the crops grown are not mentioned in the Agricultural Statistics of the Ministry of Agriculture. It may be reasonably safe to estimate, however, that the arable land now occupied by market gardeners is probably in the neighbourhood of 30,000 acres or nearly one quarter of the present arable acreage of the county. In giving reasons for this estimate, I propose to quote details as to the acreages of the various crops as returned in the Ministry's Statistics and supplement the figures by an estimate of crops not recorded. It is hoped by these means, to give you some idea of the crops grown in the county, the development of the industry in recent years, and the relative importance of certain crops to the total acreages grown in England and Wales.

One can regard potatoes in Bedfordshire as a market garden crop, as according to the *Report on the Organisation of Potato Marketing*, Economic Series No. 34 of the Ministry of Agriculture, it is estimated that approximately half of the potato acreage in Bedfordshire is devoted to first early varieties. Furthermore, in most years the bulk of the other varieties are also commonly sent to the markets "off the fork," *i.e.* the crop is not pitted or clamped. Figures for the past five years show that nearly 11,000 acres of potatoes are grown and although some farmers are growing late potatoes, this is probably offset by the larger market gardeners growing some acres of cereals —principally wheat and spring oats. These cereal crops have a two-fold-use—they enable the land to be rested by widening the rotation of crops and provide a cover crop for the broad red clover which is

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subsequently ploughed in as a green manure in the early winter. In recent years the growing of Brussels sprouts has been taken up by farmers, but sugar beet has been largely grown by market gardeners and some turnips are still grown for bunching. The land occupied by Brussels sprouts for the past five years has averaged fully 10,000 acres. These two principal crops bring us to the total of 21,000 acres. The acreage devoted to peas picked green, beans picked green, (mostly scarlet runner beans), cabbages, cauliflowers or broccoli, carrots and onions, in order of importance from an acreage point of view, in Bedfordshire and specified in Table IV of the Ministry's Agricultural Statistics, has averaged about 6,000 acres for the past five years. Though rhubarb and celery are mentioned in the returns, the amounts grown in Bedfordshire are negligible. There are more crops grown than those mentioned in the Statistical Returns. Parsley, beetroot, parsnips and marrows are relatively important and one also finds small quantities of radish, lettuce, spinach and other vegetables. It would seem that these crops probably occupy about 2,500 acres annually, thus giving a grand total of approximately 30,000 acres devoted to vegetable crops including potatoes. This figure, however, only indicates the amount of land occupied by market gardeners and not the acres, strictly speaking, of vegetable crops grown.

One cannot determine the actual acreages of some of the crops owing to the practice of half cropping or intercropping in some of the Bedfordshire districts where early potatoes in particular are grown. Perhaps illustrations of half cropping will enable you to understand better why it is that the acreages of certain of the crops in the annual returns of the Ministry are not accurate and do not give a true indication of the production of these crops.

A grower crops ten acres with early potatoes at a width of 36 to 40 inches between the rows and subsequently in May plants Brussels sprouts between these rows. He, therefore, has two crops growing on ten acres and in making his returns on the 4th June he states 5 acres of potatoes and 5 acres of Brussels sprouts. Had he been growing a full crop of early potatoes, he would have planted them in rows 24 to 26 inches apart so actually by planting wider he sacrifices one-third of his crop. It would appear that he will have the equivalent of $6\frac{2}{3}$ acres of potatoes on his 10 acres and when he has dug the crop in June, will be left with a full crop of Brussels sprouts, for the latter are generally grown in rows 36 inches apart. From a production point of view, he would be growing on the 4th June the equivalent of nearly 17 acres on 10 acres of land. The figures relating to acreages of runner beans, cauliflowers and sometimes other crops are influenced in this way.

Another example which may be of interest as illustrating the intercropping yet not affecting the acreage in the Ministry's returns in any way, is where parsley is drilled in a crop of peas or onions. In this case the full acreage of peas or onions would not be influenced and as no figures are asked for in respect of parsley acreages, the

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parsley can be regarded as one of the many catch crops for which no details are available. Generally speaking, the yield of the half crops concerned is not so good as had they each been full, and the custom of half cropping is tending to decline. Figures relating to the acreages of potatoes, beans, and cauliflowers in particular, for this county should be slightly increased when comparing with the details of counties where half cropping is not practised.

The Ministry's returns for the 4th June, moreover, do not give any idea of the acreage devoted to catch cropping. Growers clear their land quicker of the main crops than formerly, and catch cropping seems to be on the increase. A considerable acreage of spring cabbage is now drilled after early potatoes or early peas. Quantities of savoys, Christmas cabbage, broccoli and turnips are likewise catch-cropped and thus not recorded. Estimation of the acreage of catch crops grown is not easy, for consideration must be given to the amount of half-cropping practised, to the amount of potato and early pea land, and to the various acreages of early carrots and beetroot subsequently followed by these catch crops. The figure of 6,000 acres or one-fifth of the market garden land, is probably a reasonable one.

I would now like to give some indications of the development in the growing of market garden crops both in Bedfordshire and in England and Wales as shown by the acreages under certain market garden crops in the Annual Returns, and I propose quoting the figures for the years 1922 and 1932 in particular though the figures for other years have been examined, in drawing conclusions. These figures may be used for comparative purposes, though those of Brussels sprouts, cauliflowers and beans may be liable to slight error due to half-cropping.

Acreage under Certain Market Garden Crops in Bedfordshire and in England and Wales in June, 1922 *and* 1932, *and Bedfordshire Averages as Percentages of Total.*

	1922			1932		
	Bedford	*England & Wales*	*Bedford as %*	*Bedford*	*England & Wales*	*Bedford as %*
Carrots	829	14,084	5.9	440	12,490	3.5
Onions	970	3,557	27.5	360	1,890	19.0
Cabbage ..	527	27,954	1.9	1,000	33,860	2.95
Brussels Sprouts	5,606	14,951	37.5	10,400	33,040	31.5
Cauliflowers or Broccoli ..	208	10,475	2.0	420	17,670	2.4
Celery	37	5,282	—	20	7,710	—
Rhubarb ..	19	5,718	—	70	8,250	—
Beans	579	12,907	4.5	1,270	14,380	11.3
Peas	1,634	50,894	3.2	3,300	60,330	5.5

The figures for 1932 have been kindly supplied by the Ministry of Agriculture in advance and are subject to revision.

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The figures broadly indicate that the total amount of land devoted to the crops mentioned has increased by over 60 per cent. in Bedfordshire, but there has been an increase of only thirty per cent. in the country as a whole. Ten years ago Bedfordshire grew 7 per cent. of the acreage of these crops, and now the figure has increased to 9 per cent. The acreages, with the exception of carrots and onions, have extended.

The carrot acreage in Bedfordshire has diminished by about half and the onion acreage by nearly one-third in the last ten years. Only 40 per cent. of the carrot and 25 per cent. of the onion acreages of twenty years ago are now grown in the county of Bedfordshire. Twenty years ago fully 1,000 acres of carrots and 1,400 acres of onions were grown, these representing 9 per cent. and 30 per cent. of the total acreages of these crops for England and Wales. The acreage of carrots is now under 4 per cent. of that of the entire country, but one-fifth of the country's onions are still grown. I am informed that there used to be a tremendous trade in early bunched carrots consigned to the North in June and July in pre-war days, but this is now practically non-existent, and there is now a decreased demand for late carrots. Bedfordshire used to be famed for its pickling onions. Cucumbers grown out of doors are no longer to be seen, and other pickling vegetables are in no demand.

The acreages of the other reported crops have mostly been doubled in the past ten years and occupy an increased percentage of the land in England and Wales devoted to these crops. Thus we find that whereas only 2 per cent. of the cabbage acreage of England and Wales was to be found in Bedfordshire ten years ago, this has now risen to 3 per cent. The cauliflower acreage has increased from 2 per cent. to 2½ per cent. The bean acreage, formerly only 4½ per cent., is now fully 11 per cent. The pea acreage has risen from fully 3 per cent. to 5½ per cent. These figures show that there has been a greater relative increase in acreage in these crops in Bedfordshire than in the remainder of the country. The increase in acreage of these crops has mainly been in east Bedfordshire. Brussels sprouts, however, do not share this relative increase for, although the acreage has been doubled in Bedfordshire, the county now only grows just over 30 per cent. of the acreage for the whole country instead of nearly 40 per cent. ten years ago. This means that Brussels sprouts are being grown to an increased extent by farmers in other counties. One finds that the farmers of Bedfordshire, in the areas adjoining the market garden districts, and further afield too, are growing sprouts, and it is on the heavier land that the acreage has increased. Farmers are becoming market gardeners to some extent at least—by growing sprouts on their better arable fields adjoining the roads. Brussels sprout growing has been found to be more profitable than corn. Incidentally the crop is being planted earlier and consequently gathered earlier than formerly.

When one considers the position with regard to crops which are not recorded by reason of their being catch crops, or because official

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particulars of them are not required, it is more difficult to give information with precision. I gather, however, that there has been a definite increase in the acreage devoted to spring cabbage. More acres are now drilled for clearance as spring greens than formerly. The acreage planted out, as opposed to drilled, has probably not increased to the same extent. The unrecorded acreage of cauliflower and broccoli (both heading and sprouting) has tended to increase. Christmas cabbage and savoys are probably not grown so much, as the consuming public is showing preference for Brussels sprouts in the early winter, and for the same reason the acreage of catch crop turnips is likewise decreasing.

Of the more important main crops of which no particulars are given in the Ministry's Statistics, it seems probable that the parsley and the parsnip acreages may have decreased slightly, whilst beetroot and marrows are now grown to approximately the same extent as ten years ago. In most market garden crops there are fluctuations similar to those connected with the better known potato crop and one year there may be a glut of, say, beetroot which is followed by a decreasing acreage till scarcity puts prices up and the acreage in the following year is increased.

Before passing to other matters, I must, however, say a word about the potato crop. The acreage has increased as compared with pre-war days ; not quite 2 per cent. of the potato acreage of England and Wales was to be found then in Bedfordshire whereas now fully 2 per cent. is grown. It is estimated, however, that practically 11 per cent. of the first early potato acreage is centred in this county. Ninetyfold is a favourite early, and King Edward remains the main crop variety. Majestics are also considerably grown.

The Soils

Records show that market gardening was an established industry in the eastern part of the county around Sandy, adjoining the Great North Road at least 150 years ago. It is of local interest that of the 111 residents of Sandy at that time no less than 46 were market gardeners, and many of their descendents are still carrying on the specialised work in that area. In East Bedfordshire there is, therefore, the accumulated experience of generations of growers and the workmen are skilled and practised in the handling of vegetable crops. Market gardening started in that area because the land there was found to be particularly suited to the growing of early crops. You will note that I have said early crops, as this is important, in that it indicates the type of land that has been mostly cultivated by market gardeners—land open in texture, free draining, and workable at all times of the year.

There are four main soil types in the county : (1) Clay ; (2) Gravel and Alluvial ; (3) Lower Greensand ; and (4) Chalk. The clays occupy nearly two-thirds of the county and the remainder is divided almost equally between the other three types. The industry

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has been confined principally to the River Gravels and the Lower Greensands and occupies practically all the former. Both these soils are not naturally fertile, the former being a silty gravel which is inclined to set hard and very often overlying a brown sand; the latter is a poor light sand and occupies the higher ground. Each of these soils is inclined to dry out in time of drought. Presumably, for many years the gardening was confined to the Lower Greensand to the east of Sandy, where the land was sheltered from the north and east, for one hundred years ago we read that at Beeston, which adjoins Sandy on the south-west side and where the soil is of a gravelly nature, ordinary farming was practised, one farmer in particular being then famed for his cattle. At the present time practically no live-stock is there.

In pre-railway days the growers returned from London with soot and stable manure after they had disposed of their produce. London manure and soot have stood the test of time and still form respectively the basic and stimulative manures of the market gardeners. The construction of the Great Northern Railway was undoubtedly a great boon to East Bedfordshire, for the London stable manure could then be obtained at a nominal sum for the best grade, and sometimes the inferior manure could be obtained free for carting from the station. This led to an easier maintenance of the land which had been intensively cropped for many years before, and enabled the fertility of the more recently broken up land to be raised. Now we find that both the good London manure and soot are less easy to obtain. Twenty years ago the former cost 4s. to 5s. a ton at the station, but nowadays it costs 8s. to 12s. The fertility of the gravels and greensands is tending to drop as there is less of this good quality horse dung available—particularly do I refer to land occupied by the smaller growers, who are not able to buy the London manure so advantageously as the larger growers who purchase on contract. The quantity of London manure now used in the Sandy area is probably only one-eighth of what it was in pre-war days. Shoddy, being relatively cheap, is being used as a substitute. Artificial manures are more freely used—particularly nitrogenous ones for green stuff, though the use of soot has not diminished to the same extent as has the dung. The ploughing in of crop residues as well as mustard and clover, has undoubtedly aided in the building up and maintaining the fertility of these hungry soils.

The practical value of bulky organic, and possibly green manuring, to successful crop husbandry in the free draining soils, will be further appreciated when it is realised that the district is one of very low rainfall. It is one of the driest areas in England and yet the diligence of its cultivators had made it one of the most intensively cultivated and productive parts of the kingdom. The average rainfall for the past twenty-five years has only been 23.7 inches per annum. For the last ten years the average has been 24.5 inches and for the previous ten years 23.5 inches. There are, of course, years when the rainfall reaches 30 inches. The year 1930 was one, but in 1929 only

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20.16 inches were recorded, of which 12.72 inches fell in the last three months. As summer rainfall is much desired by the market gardener, this was a disastrous year. In the extremely dry year of 1921 the rainfall was only 10.12 inches—there was not any rain worth mentioning from April to October. Fortunately the rainfall is generally fairly well spread out over the year. It must be apparent that the use of bulky organic matter as a means of improving the water-holding capacity of the soils and so lessening the risks attendant upon drought, is of great importance in the maintaining of a good level production. Artificial manures are more successful in a wet season. If the season is a dry one, and the soil not retentive of moisture, one may broadly say that no matter how much concentrated artificial manure one may use, a poor crop is apt to result. A further examination of the rainfall records for the past twenty-five years shows that in ten of the years the amount of rain has been below the average of 23.7 inches for the period. Growers realise the necessity of endeavouring to maintain the humus content of their soils, costly though these endeavours are, as it is in these dry years that crops are light and prices tend to be high.

There is no regular form of rotation for crops. A market gardener endeavours to keep his land in such good heart that rotations are not so essential as in ordinary farming practice where natural fertility is more relied upon. The rotation, if any, is generally a short one. It will be realised that with larger acreages of potatoes and Brussels sprouts in particular, and smaller acreages of other vegetables, it is exceedingly difficult to avoid the large acreage crops following one another closely. There are exceptional fields which, on account of their earliness, have been devoted to early potatoes for many years in succession—the potato crop either being half cropped with something else, or if a full crop then followed by a catch crop. One is finding, however, that potato sickness is compelling growers in at least one area to reconsider their cropping system. Because these light soils tend to be lime-deficient and some are now markedly so (growers having neglected liming owing to the fear of producing scab on the all-important potato crop) one hears that although Brussels sprouts have only been grown a comparatively short time, the land is already becoming Brussels-sick. There are indications, too, that the light soils are rather low in available potash, though early potatoes and cruciferous crops apparently do not require much of this.

I stated earlier in this paper that the farmers on the heavier soils —the better boulder clays in particular—are now growing Brussels sprouts as well as late potatoes. This is partly because the quality of the sprouts from these fresh areas tends to be better than from the districts where the crop has been grown in rather close succession. These boulder clays suffer less in a dry summer, and in that way carry a crop better, and in the case of King Edward potatoes, produce a more uniform sample than do the lighter soils where drought causes second growth. The farm tractor is enabling a suitable tilth for the

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growing of potatoes and Brussels sprouts to be more easily attained on these heavier soils, and motor transport is enabling the produce to reach the station or market more readily than ten years ago.

Possibly some examples of crop sequences may be of interest in showing the methods of growers. Potatoes may be followed by spring cabbage, followed by Brussels sprouts, followed by early peas, followed by parsley, and again potatoes. Or another similar one might be potatoes followed by wheat or odd crops such as beetroot, parsnips and marrows, followed by Brussels sprouts and then peas.

A narrower sequence might be Brussels sprouts, potatoes, spring cabbage (catch crop) and then back to Brussels sprouts ; or early potatoes followed by spring cabbage, followed by runner beans, thus giving three crops in two seasons. These latter two sequences would not necessarily be maintained for long, as some other crop or crops would be interposed.

A widening of the rotation in many cases is highly desirable, as otherwise trouble by way of pests and diseases is not easy to avoid. Science has not yet been called upon to any great extent to find direct remedial measures, so much work in this connection remains to be done.

Size of Holdings and Labour

It is impossible for me to state the most usual size for a market garden holding because of the smaller and larger growers being so intermixed, particularly in those areas where the industry has flourished longest. Market gardening started in a small way, and it was difficult to acquire suitable land as farming was relatively prosperous, and the large landowners were prejudiced against the growing of vegetables, as such crops, being sold off, were considered to exhaust the soil. Suitable fields are said to have made as much as £350 per acre in the middle of last century, and more recently £200 per acre or more has been paid for similar land. Thus there were numbers of growers cultivating scattered small areas in different parishes, some of the land being early and some late. Twenty or more years ago, the County Council acquired farms and divided them into small lots of one or two acres or more and the policy was continued after the war. Other landowners did likewise, for there was a great demand for land. Now there are large open fields resembling those of pre-enclosure days. Rents are high as the plots are small, and here again the smallholder suffers, for there are no buildings excepting very limited accommodation in the villages. Fifty to seventy shillings per acre is quite a usual rent, and specially good land may make £5 per acre. In pre-war days, when corn-growing became less remunerative, farmers on the lighter soils commenced to grow vegetables and land also began to change hands in larger areas. Some of the larger market gardeners took over ordinary farms both on the gravelly and slightly heavier soils. Such land could then be bought at quite nominal figures. Some larger farms were subdivided into compact holdings, complete with house and buildings.

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The smaller grower may still have land in different parishes, and now the larger market gardener may grow extensively in one parish or have several farms—indeed, some may have a stand in a London market for the selling of their produce or of that of others on commission.

There are, however, a great number of smallholders. Practically 30 per cent. of all holdings in Bedfordshire do not exceed 5 acres in extent, and most of these will be in the market gardening areas. The corresponding figure for England and Wales is 18 per cent.

The fall in prices of produce generally is being felt by all market gardeners, the smaller man in particular is finding it extremely difficult to get a living. His land is dear, he cannot purchase manure so well as the larger grower, and the fertility of his scattered fields is decreasing. He has no means of keeping livestock for he has neither buildings nor fenced fields, nor in many cases grass. In some areas, at any rate, the larger grower is taking over some of this land and the small man is entering his employment or that of another for seasonal work at piece work rates. The piece work system is very common. A usual rate of pay for gathering Brussels sprouts is 2s. per cwt. (sixpence per bag), and in a reasonable crop 5 cwt. can be gathered per day. Potato digging costs say 15s. to 16s. per ton in a four to five ton crop, or 10s. to 12s. in, say, a twelve-ton crop. Women pick peas for 1s. to 1s. 3d. per 40 lb. bag, and runner beans from 6d. to 8d. for a similar amount. There is scarcity of labour at peak periods, so good wages are earned. The wages for regular workers are generally higher than in the purely agricultural area. The piece work system is not a good one however, where careful grading of produce is necessary, unless the supervision is close.

Some idea of the wage bill of the market gardener may be formed when one considers that three men in addition to the grower will be employed on a fairly intensively cultivated holding, of say 20 to 25 acres in extent. On larger holdings, where some corn may be grown, one man will be employed for every eight to ten acres. Female labour will be needed in addition for pea-picking, and possibly extra hands for potato digging.

I am indebted to the Ministry of Agriculture for supplying figures relating to the number of workers—excluding the occupier, his wife and domestic servants—employed on holdings in 28 parishes in the eastern (market gardening) part of the county. A few of the parishes are not market gardening ones, and there are, moreover, many smallholders, yet one person is employed for every 18 acres of land. The equivalent figure for 25 parishes of similar area on the heavy land area in the north of the county, where wheat is the main crop, is one man for every 54 acres. In the latter case only 45 per cent. of the land is arable as opposed to 75 per cent. in the former.

I venture to suggest that we may see a return to the more self-supporting type of holding with buildings for livestock to make manure of the straw which a larger market gardener might be

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tempted to grow now that wheat prices are being stabilised. Some measure of help to the livestock industry would encourage this, and sheep folded over crop remains, would also help to augment the decreasing supplies of London manure. Hitherto the majority of market gardeners have not had any reason to require livestock. A more centralised holding would enable greater use being made of the tractor and doubtless other mechanical means may be employed to limit the now costly labour bill.

Transport and Marketing

The opening of the Great Northern Railway from London to the North in 1863, followed by a branch line of the London and North Western Railway from Bletchley to Cambridge, placed growers in East Bedfordshire in an advantageous position for sending their produce into the London markets, the Northern and Scottish industrial areas, as well as Birmingham, and other consuming centres in the Midlands. Express goods trains have been running daily for more than thirty years from Sandy Station. One such train leaving Sandy at about 5 p.m. enables produce to be in the Glasgow markets by 6.30 a.m. the next morning. Excellent facilities enable the markets of Lancashire, West Yorkshire, the North Midlands, and West Midlands to be similarly served. Truly the railways have taken a big part in the building up of the industry, and it is said that possibly more market garden produce has been loaded by growers at Sandy than at any other station in the kingdom.

We are all aware, however, then transit rates vary. The larger the consignment the more favourable the terms, so that the large grower is able to place his produce in the markets more cheaply than the smaller man, or alternatively he can send it further. Many of the large growers, therefore, send produce to the North and cater for that trade, whereas the London or Midland centres are supplied by the smaller acreage gardener. It will be realised that the larger grower can favourably supply any district. The telephone keeps him in touch with all markets. Railway rates for transport, however, remain rather too high, and road transport contractors with motor lorries find a demand for their services, particularly from the small consigner, as a load can be made up for the London markets by collecting from several holdings. The transporting of produce by road has increased enormously of recent years—truly history is repeating itself, for the gardeners of seventy years ago had to go the same way to London, only more leisurely. The market garden area has widened away from the railways, and produce can be taken straight from the fields to the markets at lower cost and with less trouble to the grower. Peas picked in the early morning can be on sale in the London shops, forty miles away, within three hours of their leaving the field or it is possible for them to be in cans at the canning factory in approximately the same time.

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I understand that commission salesmen do not like the extension of the transporting of produce by motor lorries for two reasons. First, there is an increasing number of growers who, with their own transport deliver produce direct to the shops, and of dealers who buy the produce in small quantities from growers for disposal in a similar way. The smaller grower who may have difficulty in marketing his produce has of recent years found the dealer to be a useful man. Secondly, the delivery of produce to the market stands is not so easily controlled ; the salesman cannot tell exactly when the produce will arrive, and, when it does arrive, he may be already well supplied. The contractor undercuts the railway by taking return loads, so naturally on arrival at the market, he wishes to get cleared, and this sometimes leads to an overstocked appearance of the stands with a consequent tendency towards the lowering of prices. The railway companies, however, inform the salesman how much produce there is for delivery and will temporarily hold the produce and so regulate the supplies to the stands. Delivery of produce from the station direct to big purchasers can be arranged without the produce needing to be exposed. Certain commission salesmen have their own transport lorries but these naturally are under their own control.

It is desirable that there should be few sellers and many buyers for the maintenance of relatively high wholesale prices. In other words the selling should be in the hands of a few who would not tend to undersell one another. The increase in the number of sellers (dealers) to the shops in the consuming centres is already tending to aggravate the downward movement in price, as naturally a perishable commodity must be disposed of quickly. On the other hand, the producer wants an increased number of buyers and these dealers are buyers from him, therefore, the more dealers there are the greater will be the growers' chances of being able to hold out for a fair price, provided, of course, that the number of dealers in proportion to retail shops is not too great. The presence of dealers has acted as a stimulus to the commission salesman—possibly dealers have helped the industry by making contact with the smaller shopkeepers, who may not for various reasons be able to buy from the wholesale markets. Transport contractors are increasing the size of their lorries and one sometimes notices bad loading of mixed consignments with perishable and light produce suffering, and some growers are already returning to railway transit on this account.

The increased production of horticultural crops and the consequent fall in prices is causing greater care and attention to be devoted to the type of produce offered on the markets. It is very usual for growers to tie the bags with a particular colour of string for identification purposes and one sees Brussels sprouts being increasingly consigned in nets rather than in small sacks. Nevertheless, there are some who consider that some measure of control of the marketing might be desirable for the Industry and we are aware that the potato crop is already being considered from that point of view. There is one canning factory taking a considerable quantity of peas

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from the county, and a number of growers are attracted by the certainty of a fair remuneration for their supplies and would be prepared to grow other crops similarly. The development of this latter industry should help to stabilise conditions.

Summary

The annual Statistical Returns of the Ministry of Agriculture do not give a true statement as to the acreages of some of the crops grown nor is any reference made to others. Catch cropping is practised and such crops are not recorded. The acreage of many crops has been increased and the extension generally has been greater relatively in Bedfordshire than in the county as a whole.

The Industry has been mainly confined to the lighter soil area in East Bedfordshire but extensions—mainly by means of Brussels sprouts and potatoes—are taking place on the better class Boulder clay soils. The lighter soils have been made productive by the use of London horse manure, the supply of which is decreasing. Bulky organic manures seem desirable as the area is one of low rainfall. Many cropping sequences are too narrow now for safety.

Smallholders are numerous and their fields are very scattered. There being no conveniences for the keeping of livestock, fertility is tending to decline on the smaller holdings. Labour is not very plentiful and piece-work is usual. Wages are higher than in agricultural districts. Market gardening affords much employment. Holdings may have to become more self supporting in manure and more centralised for limiting labour costs.

The railways have taken a big part in developing east Bedfordshire—excellent transport facilities are provided to markets in all parts. Road transport by motor lorries has developed greatly but the system has weaknesses. Dealers have increased rapidly in numbers and some measure of controlled marketing may be desirable. Canning may help to stabilise the industry.

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CANNING OF FRUIT AND VEGETABLES: WHAT THE CANNER WANTS

By F. HIRST, M.Sc.

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The Growers' Standpoint

The rapid development of the canning industry during the last six years has brought about a material improvement in the outlook of the fruit grower. The situation in all branches of horticulture at the beginning of this period was very discouraging, and the creation of a new market for the produce of the orchards and market gardens has done much to brighten the prospects of those engaged in the growing of fruit and vegetables.

Fruit prices in this country have always been liable to violent fluctuations on account of the uncertainty of the climate with its consequent effect upon the crops. Any extremes thus caused are disadvantageous to the grower, for the high prices ruling in a season of short crops are not sufficient to offset the low yield obtained, while the low prices offered during a glut period may not even be sufficient to pay the cost of picking the fruit.

In the years previous to the advance of the canning industry to a position of economic importance to the grower, the only outlets for the fruit crop were to the fresh fruit market and to the jam manufacturer. The amount taken by the latter was considerable, but the position changed during the next few years when large quantities of cheap fruit pulp, preserved in sulphur dioxide, were imported into this country for the manufacture of jam. The partial loss of a valuable outlet, and the rise in imports of fresh fruit, caused prices to fall, and in many cases the growing of fruit became unprofitable.

By the year 1929 the demand for fruit by the canner began to make itself felt, and the rapid expansion of the industry since that date has exercised a very noticeable effect on the prices of certain fruits.

The recent imposition of a tariff on imported fruit and pulp has caused the jam manufacturer to look to the home market to supply him with a proportion of his requirements, and this has helped to maintain or raise prices, but more particularly it has served as a means of disposal of fruit which is not quite up to the standard required for the fresh market or for the canner.

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The effect of the entry of the canner as an important buyer was first to give a greater stability to prices, and to protect the grower against a severe slump in glut seasons. But during the past year the increasing demands made by the industry, taken in conjunction with the change in the political situation, has caused fruit to become a rising market, even in times when other products of the land are in a state of severe depression.

The Canner's Standpoint

The first task in developing a canning industry in this country was to build up a demand for fruits other than those normally imported from abroad. Peaches, pears and apricots do not yield sufficiently well in England to produce crops which can be marketed at a price which would be economic to the canner, and for this reason attention had to be confined to soft fruits, plums and cherries. The quality of the strawberries, raspberries, loganberries, currants and blackberries grown in the British Isles is unsurpassed by any other country, and with the provision of such excellent substitutes for the imported peaches and pears, the canning industry has been able to make rapid strides in a very short space of time.

Unfortunately, these berries and currants are fruits of high initial cost, and the canned products are apt to be more expensive than the imported articles. The only fruits which can meet the foreign competition on a basis of price are gooseberries and plums, and of these the latter are very popular— in particular such varieties as the Victoria and Pershore.

The chief difficulty confronting the canner in this country is precisely the same as that which faces the grower—namely, fluctuation in prices of the fruit. This makes it difficult to foretell the extent of the season's pack, and causes unsteadiness in the wholesale prices of the canned products.

It has been stated that the advent of the canner on the fruit market has contributed towards a general hardening of prices to the material advantage of the grower. Unfortunately, this also acts as a check on the development of the industry, the remedy for which must be sought in the establishment of a proper understanding between the industry and the fruit grower.

Co-operation in the Industry

In 1925 the only canneries operating in the country were three or four of the earliest pioneers, but from that date rapid progress has been made, and by the year 1932 the number of factories has risen to eighty-four. This spectacular advance, which developed in the first place in the three main fruit-growing areas of Cambridge and Wisbech, the Vale of Evesham, and Kent, later spread to the areas of lesser importance, and at the present time there is no large fruit growing centre without at least one cannery.

It is gratifying to note that success attended this sudden development, in spite of the fact that very few trained men were available for managing the factories. This difficulty was overcome

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by the provision of technical advice and assistance on all the theoretical and practical problems of canning by the Campden Research Station, which had been engaged for several years in building up an organization for this purpose. The subsequent action of the can-makers in supplying closing machines and full service with their cans, enabled the firms engaged in the industry to eliminate the chief source of trouble which is normally associated with the closing of the cans.

By co-operation between the canner, can-maker, machinery manufacturer and the Research Station, the industry has been able to develop along sound scientific lines from the outset, and this, more than any other factor, has been responsible for its success.

The next stage of co-operation which becomes more urgent the greater the extension of the industry, is between the canner and the grower. The very large quantities of soft fruits required for canning has necessitated the planting out of new acreages of fruit of the varieties suitable for canning, and to guard both parties from the fluctuations in price which are so harmful to trade, a large proportion of the new fruit must be grown under contract at prices fixed at a definite figure for several years.

Quantity of Fruit Required

The output of canned fruit in 1932 is estimated at approximately fifty million cans ; this is very satisfactory in view of the fact that the plum crop was scanty and the damson crop a failure. As stated previously, plums and gooseberries are the chief fruits with which the English packers can meet the competition of imported peaches, pears and apricots, and a large quantity of plums are packed if the crop is good and the prices reasonable. During the last season the high prices ruling caused the output of this fruit to drop below the amount previously anticipated, and in a normal season a higher proportion of plums and damsons would be packed.

In view of the extent of the 1932 output, and the increasing demand of the public for British canned fruits, it may reasonably be expected that the 1933 fruit pack will amount to about seventy million cans, provided the fruit is available. It is extremely difficult to anticipate the manner in which this quantity will be split up amongst the various fruits, as the abundance of the crops, the market prices of the fruits and the relative popularity of the various canned products, all tend to alter the balance of these figures. As a rough estimate the fruits might be packed in the following proportions :

Gooseberries	6 per cent.
Strawberries	18 ,,
Raspberries	13 ,,
Loganberries	6 ,,
Blackcurrants	5 ,,
Cherries	2 ,,
Plums and Greengages ..	36 ,,
Damsons	10 ,,
Cultivated Blackberries ..	3 ,,
Apples and other fruits ..	1 ,,

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Taking these figures as a basis we are enabled to estimate roughly the tonnage of fruit required by the canner, and it may be worth while to deal with each fruit separately.

Gooseberries

This fruit cans remarkably well, but is not yet appreciated as well as it ought to be by the public. The quantity required by the canning industry next year will probably be in the region of 1,400 tons. For canning, green under-ripe gooseberries of medium size are preferred, but the berries must not be too immature or they will have little flavour. The varieties most popular are Keepsake and Careless.

Strawberries

There is a great demand for canned strawberries, and the quantity of fruit required would be about 4,000 tons for a twelve million can pack. To be suitable for canning the berries should be of medium size with good colour and flavour ; they should be firm in texture and free from ridges, wrinkles and black markings at the base of the berries. The varieties in greatest demand are Sir Joseph Paxton and Royal Sovereign.

Raspberries

The outlook for the raspberry grower has not been very encouraging during recent years. The greater part of the crop was originally planted to supply the jam manufacturer, and the demand from this source fell off rapidly when cheap, foreign fruit pulp came on the market. The canning industry only requires fruit in first-class condition, but the demand is now sufficiently large to encourage the planting of new acreages. It is estimated that about 2,500 tons will be required next season. Raspberries are easily bruised, and careful picking is essential. The berries should be gathered whilst they are firm and the fruit should be transported to the cannery in shallow baskets.

Loganberries

There is a great shortage of this popular fruit for canning, and we are still importing considerable quantities of canned loganberries. The demand for loganberry canes now exceeds the supply, and the quantity of fruit packed by the canner will depend on the amount available. A three million can pack would require about 800 to 900 tons of loganberries.

This fruit is much firmer than the raspberry, and will travel very much better. Both these fruits are liable to contain maggots of the raspberry weevil, and such fruit is useless for canning. The grubs leave the berries when the latter are heated during the process of sterilization and float in the syrup. Any grower, therefore, who contracts to grow raspberries or loganberries for canning, should take steps to control the weevil or the fruit may be rejected when

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delivered. Sprays containing Derris Extract, as recommended by the East Malling Research Station, have proved very efficient in controlling this pest.

Blackcurrants

Very few fruits preserve their flavour when canned so well as blackcurrants, but this fruit is not universally popular. A pack of three and a half million cans would require about 1,000 tons of fruit. Firm, ripe, juicy fruit of good size is required by the canner. The majority of the varieties commonly grown are satisfactory for canning.

Cherries

The quantity of this fruit canned is still small in view of the extent of the foreign imports—particularly from Italy—and only a few varieties are suitable. The Napoleon Bigarreau and the Kentish Bigarreau are both satisfactory for colouring red to take the place of the imported cherries. The sub-acid and acid cherries, such as the May Duke and the Morello, have an excellent flavour when canned, but neither is grown to a sufficiently large extent to supply the needs of the canner.

Plums and Damsons

The price of these fruits fluctuates greatly, but very large quantities are used for canning. In a favourable season about 10,000 tons of plums and 3,000 tons of damsons might be required. The best varieties are Victoria, Yellow Pershore, Purple Pershore and the Prune damson.

Cultivated Blackberries

Certain varieties of this fruit give excellent results when canned, and these are likely to become popular in the near future. The extent of the pack will largely be governed by the quantity of fruit available. The best varieties at present grown on a commercial scale are Black Diamond—a Californian variety established in the Vale of Evesham —and Himalayan Giant.

Apples

These are mainly packed sliced or quartered in gallon cans. The quantity canned will depend on the price of the fruit and the extent of foreign competition, but the recent tariff should encourage production. Half a million cans would represent roughly 2,500 tons of apples.

The requirements of the individual fruits given above may vary considerably, but the total quantity of fruit required to pack seventy million cans is certain to be at least 25,000 tons, which represents the yield of 15,000 to 20,000 acres of fruit. Whether this quantity will be available at prices which the canner can afford to pay, remains to be seen.

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Vegetables

The vegetable canning industry has also made highly satisfactory progress during the last four years. The prohibition of the use of copper sulphate in green vegetables, which came into force in 1927, threatened to destroy the small pea canning industry which was in existence at that time, but the discovery of an alternative and perfectly harmless method of obtaining the desired results put new life into the industry, and the developments since that date have been rapid.

The output of canned fresh peas in 1932 has been estimated at twelve million cans, which represents the product of about 4,000 acres of land under this vegetable. The peas are grown almost entirely under contract, and the price paid is sufficiently attractive to cause keen competition amongst growers to secure the contracts each year.

At present the Lincoln is easily the most popular pea for canning. In the past the variety Alaska has been canned to a certain extent, principally because the seed will withstand the adverse conditions often experienced in this country during the early months of the year. This variety, however, if not picked just at the right stage gets starchy very quickly, and for this reason it is not as popular as it used to be. A satisfactory early pea for canning is urgently required, but so far no variety has been discovered to take the place of Alaska.

In addition to the fresh picked pea there is a very great demand for the canned, resoaked, dried pea, which is one of the chief starchy foods of a large proportion of the British public. The best pea for canning in the dried state is the English Small Blue, grown mainly in Lincolnshire, and the pack during this year will probably be about thirty-five million cans.

Other vegetables, such as dwarf beans, carrots, beetroot, spinach, turnips, celery, cauliflower, etc., are being canned to an increasing extent, and the annual pack of these vegetables at the present time is in the region of eight million to ten million cans.

Dwarf and runner beans as usually grown in England are not very satisfactory for canning, as they are stringy and too dark in colour, but there is an excellent American variety—Keeney's Stringless Green Refugee—which grows quite well in this country.

Beetroot for canning should be small, and the plants should be grown much closer together than is the case with beet for the fresh market. Roots about 1½ to 2 inches in diameter are most in demand, and Detroit Dark Red and Globe are the best varieties.

When grown for canning, carrots should not be thinned out to any great extent, as small to medium-sized young roots are principally required. Good varieties are Champion Horn, Select Stump Rooted Early Horn, Early Nantes and Nantes Stump Rooted.

Turnips should also be young and small—not more than 1½ to 2 inches in diameter. White and Red Milan are both good.

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There is a fair demand for canned celery hearts, but with the ordinary type of celery there is too much waste. Experiments have been carried out this year in an endeavour to find a good dwarf type suitable for the purpose, but the canning tests on the many varieties which have been grown are not yet completed.

Canned asparagus is very popular, and there appears to be scope for the growing of this vegetable for canners. But new methods will have to be introduced, as the large amount of hand labour at present involved in the growing of asparagus makes the product too expensive for canning, except as a luxury pack.

Future of the Industry

The demand for English canned fruits and vegetables has been very encouraging, and the prospects of considerable further developments particularly in the export field are bright. In order that this expansion should be affected with the greatest benefit to all concerned, it will be necessary for the canner and grower to understand and appreciate each other's difficulties, and towards this end to co-operate in the development of new acreages of fruit and vegetables grown specially for canning.

As every important horticultural centre is now provided with at least one cannery, it would be to the advantage of the industry as a whole if the future expansion took place by extension of the existing factories rather than by the creation of a multiplicity of smaller units. If the latter procedure were adopted the industry would be hampered by excessive internal competition, with subsequent price-cutting and lowering of standards of quality ; moreover, the existing factories are already equipped to pack more than double this year's pack if the fruit was available. The present position of the canning industry is healthy, but at the same time it is increasingly obvious that the future prospects are similar to those encountered in other industries where high quality and high efficiency are the only true guarantees of survival.

Even in these days of severe economic depression the canning industry has helped to transform the outlook of the fruit grower from a condition bordering on despair to one of considerable hope for the future. In the space of six years the industry has risen from a factor of negligible importance to one of great practical value to the grower. The canner already asks for 25,000 tons of fruit, which is the equivalent of almost 20 per cent. of the annual crop of the various fruits in question. In addition to the 15,000 to 20,000 acres occupied in growing fruits, the canner requires the product of about 7,000 acres of vegetables and about 5,000 tons of harvested Lincolnshire peas. This demand has given the grower a rising market for fruits, a steady, profitable price for vegetables, and a reasonable safeguard against the worst effects of his most formidable economic danger—a glut crop.

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CHANGING FROM FARMING TO MARKET GARDENING

By C. T. Joice

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I should think most people here know what the "Norfolk four course system" means, and I should like to say that system has served Norfolk generally, and my district in particular, very well during the last century. All the principal landowners made it part of their tenancy agreements that the rotation should be strictly adhered to; any part of the consuming crops sold had to be replaced by artificial feeding stuffs or manures, and a complete record of cropping had to be kept, and if two successive white crops (corn) were taken the tenant was fined for dilapidation. This rotation was Wheat—Roots—Barley—Hay. It will be seen that this rotation of cropping meant two cash crops and two consuming crops—in other words, half the arable land was in cash crops. As I have said, that system served my county well while prices of corn and meat were fair in comparison with the costs of production. I must explain what I mean by my district. Take a line from Cromer through Aylsham and Wymondham and on to the south boundary of Norfolk, and on the other side a line from Lynn to Hertford. The extreme east and west portions of the County of Norfolk are far more productive, and it is not necessary there to feed the crops on the land; in fact, if sheep are fed on some of the lands the crops are laid and almost ruined in consequence. So I call my district a poor one, and the old four course system served it well.

When, however, the prices of corn and meat fell, farmers were forced to alter their system of cropping to something more remunerative, and most farmers changed to a *five* course system, which allowed three corn crops in the rotation, barley or oats following the wheat crop. The five course system served my district well also.

By this time (1922) a good many farmers were growing sugar beet, which took the place of part of the root shift as a rule. In 1924 the price of barley was very good; the early sales of best barley in Norfolk were at about 80/- per quarter. I made 90/- of 150 quarters—so that although the sugar beet subsidy was in being in 1925, with a guaranteed price of 54/- per ton for beets of 15½ per cent. sugar content, the price and demand for barley in Norfolk the previous year made barley growing a better proposition than sugar beet, and barley therefore was sown rather than sugar beet in 1925, in spite of the Sugar Beet Subsidy Act.

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The further decline in corn prices from this time was causing farmers to turn more to sugar beet year by year; the prejudice of the older farmers against it was gradually weakening; one of their strongest arguments against the crop, that the crop was ruining the land, was being disproved on many farms by the more progressive farmers; it was proved that cattle could be fattened as well on sugar beet pulp at a lower cost (especially for attention) than on swedes and mangolds. So the same quantities of cattle were kept. The straw was made into muck and the fertility of the soil maintained.

On the lighter lands, where it has always been necessary to sheep heavily for the barley crop, it had been the practice to leave one-third of the swede crop on good land and one half, or in some cases the whole, crop to be fed off with sheep on lighter lands; this I have no doubt is necessary for maintaining the fertility of lighter soils and, I would say, on those soils get the drill as near the sheep as possible. I have found, if the sheep go out of the gate as the drill comes in, it generally means a better barley crop.

Now, in most cases it was found that enough residue of the sugar beet crop is left for the sheep to maintain the fertility of the lighter soils, although artificial manures are being used more year by year where the financial position permits. Anyhow, it will be seen that the farmers were, in this way, making part of the root shift a cash crop, and although a portion of the cash for his sugar beet had to be in the form of pulp, bought to be fed to cattle, the farmer had a good surplus after the quantity allowed to him by the factory had been paid for, I found that, as a rule, one ton of sugar beet pulp bought for every acre of beet grown, would keep the land in a good condition. It was taken as a rule, in the district in which I live, that a root crop should graze one and a half beasts to the acre. The beasts would be bought as stores from September to November weighing about 10 cwt. live weight, so you can see that one ton of pulp, plus the usual ration of cake and meal given with the roots would fatten that type of beast and the sugar beet tops left would allow sheep to graze as long on the land, and (with the ewe flock and store sheep) as well as they would have done on one-third of a swede crop; so it can be seen that the sugar beet crop has played an important part in Norfolk farming, it being thus possible to make the straw into muck and sow to the stronger soils, and the sheep playing their part on the lighter soils. I feel I must take this a little further or I'm sure I shall leave some wondering what happens after the sugar beet tops are finished. I did not stop growing roots altogether. I found I could keep the breeding flocks on the tops until lambing time, say, February 14th, and then to swedes, which I had cut down to 1 acre per score ewes; this suffices until the middle of April, and by that time I have grasses ready to graze.

I think this system, including the growing of sugar beet was the best for the land in my district, but I saw the system in danger so far as I was concerned through the geographical position of the beet factories, and I started experimenting with malt culms plus pulp.

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(The factories did not sell pulp except to growers). My experiments were made with half-bred Hereford-Welsh, and although not put up till January they did quite as well as those fed on pulp only. It will be noticed that both culms and pulp are products of our local lands.

Now, when the sugar beet subsidy fell in 1931, and with it the price of beet, it put sugar beet as a paying crop out of the question so far as I was concerned. I was so far from the nearest beet Factory (at King's Lynn) that I could not get my beets delivered under 8/- per ton by road, or by road and rail. Transport costs reduced the price of my beets at the nearest factory to 28/- per ton, which was quite useless to me ; so I had to think of something else.

For some years I had been growing a few vegetables of the cabbage variety, mainly for sheep, although occasionally it had been profitable to sell the vegetables for human consumption.

In 1918 I had started to grow sprouts and broccoli, but corn prices, and the labour shortage at that time cut this out. Recently I decided to produce on a larger scale and in greater variety. Now, the question was, how to maintain the livestock population on the farm. In my district it is desirable, if not imperative, to keep up the numbers of livestock. I made up my mind to grow cabbages for early feeding on the better land, for the sheep to start on when the grasses were finished, and after these the sprouts for the ewe flock until lambing ; then swedes or turnips. Carrots can be, and are, used for all classes of stock, from young growing cattle to the dairy herd, and for horses as well, allowing the corn ration to be cut down. So all split, diseased, or wormy carrots are used on the farm, and although I can, through certain friends who are still growers of sugar beet, get all the pulp I require, I used the unsaleable or unsuitable portions of the vegetable crops for stock feeding. I can hardly be called a market gardener ; I must, I think, be called a vegetable grower on a farming basis.

When turning to vegetable growing, I tried to keep all operations as near the ordinary working of the farm as I could ; all cultivations have been as near the usual for this district as possible, low enough perhaps to be criticised by market gardeners. I use mechanical power wherever I can ; for instance, the sprouts being planted on squares allow of cross cultivation. This is done by a tractor-cultivator both ways—with two chisel $2\frac{1}{2}$ inch points and one 11 inch "A" point in each space. This cultivation makes a good tilth for aeration and letting in the hoe for weed killing. I also have a "Morris" motor-car fitted with hoes and can with this cultivate the bottoms of the spaces in either 36, 24, or 18 inch spacing. Both these are useful implements, getting over about 15 acres per day, that is, $1\frac{3}{4}$ to 2 acres per hour, and although not getting quite so near the plants it does more than double the work, and much deeper, than horse hoes. They can be used until the plants get about 15 inches high, and at a low cost, one man using either tool, but they must be carefully driven. I ought to say the tractor wheels have to be

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spread for this purpose, but the work is quite well done, and little damage is done to the plants. In this way hand labour is reduced to a minimum both for horse working and hand hoeing. I have seen an ideal tractor attachment for this work, and I hope it will be produced shortly, as I consider this invention will revolutionize arable farming and market gardening.

The greater part of the Brussels sprout crop is *planted* but the rainfall being very low in my district planting is not very reliable. Although it is almost impossible to get " autumn earlies " any other way, I do not think it advisable to rely on a very big portion doing well after being planted. Last spring I re-planted over 10,000 sprouts per acre, more than double the number originally planted. I went over to make up the blanks four times, owing to drought and pests, chiefly slugs. I had a neighbour who planted 10 acres, next to my farm, that were attacked with slug and so affected by drought that he ploughed it up, and sowed swedes.

All the cabbage and savoys are *drilled* with the exception, perhaps, of a part field not cleared of another crop, or too foul with weeds at the time for sowing ; and I am sure that although a fair crop of corn can be grown with weeds, it is no use trying to grow vegetables if the land is not fairly clean.

I feel I must look back to the reasons which caused a change to be necessary, and on doing so I find that, taking agricultural produce at pre-war prices and the cost of labour at about 120 per cent. above pre-war, it is obvious that something must be done if labour is to be employed in agriculture. Corn is below pre-war, especially barley which is the chief cereal in my district. That and meat have caused the change which we have seen taking place. Personally, I want to see these lands still growing those fine barleys they are capable of growing, and producing the same prime beef and mutton they have been doing, but I have no doubt that a very few more years under present conditions will see not only the majority of the farmers in my district " broke " but vegetable growing so much overdone that it will be a factor contributing to financial troubles, rather than financial gain.

I therefore ask all market gardeners to realise how important it is that corn growing and meat production should be upon a profitable basis.

I feel very strongly that if any government viewed the Land from the point of view of the production and maintenance of new wealth, it would be far better for the country generally. I cannot help saying how foolish I think the present system is—sending British capital abroad for foodstuffs for our workless people to eat, while we have the land here capable of growing far more than it is doing at present, at least in the district in which I live. And this at a time when we should curtail our imports, if we are incapable of increasing our exports ! In my district the average loss to the farmer has been £9 per acre over a period of 10 years. My own accountant does the accounts relating to 60,000 acres, which showed

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losses amounting to £90,000 in 1931, averaging 30s. an acre, and he tells me that the average loss will be not less than £2 per acre this year, or £120,000. Say £210,000 lost on 60,000 acres in two years; a simple calculation shows that my district must have lost well over a million of money by way of farming capital in that short time, to say nothing of the previous eight years. I have no wish to reduce the labourer's wage, but if arable farming in West Norfolk is to continue we must either have economic conditions all round, or artificial prices for our produce. The cost being now artificial we have to face an economic basis laid down by countries having a lower standard of living than ours.

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MARKET GARDENING IN THE EVESHAM DISTRICT OF WORCESTERSHIRE

By R. C. Gaut, M.Sc., N.D.A.
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Vegetable-growing in the Evesham district is an old-established practice, but no evidence is extant as to when it commenced as a commercial venture.

There are many signs of Roman occupation, and it is not at all improbable that these small scattered areas have been cropped more or less continuously for fifteen hundred years. The soils are very deep and dark-coloured, engendered by long cultivation and manuring; and in some places it is possible to excavate three to four feet of earth that has, at one time or another, been completely turned over during the course of cropping. Of these, the land in the vicinity of Evesham Abbey is an outstanding example; this area of almost black soils is extensive and has, doubtless, been intensively cropped for several centuries.

The widespread employment of hand implements is a prominent feature of land management; the explanation is probably three-fold. A writer of some 140 years ago referred to the cultivators as the Evesham gardeners, and as gardening is rarely associated with the use of horse implements the expression adequately distinguished these growers from the arable farmers of the neighbourhood. Also, many of the holdings are small and the provision of heavy equipment would be expensive. And further, it is a well-recognised fact that heavier crops follow after digging than after ploughing.

In the Vale of Evesham the intensive system of market-gardening has been highly developed. To a great extent this has been due to the following several factors: security of tenure under the Evesham Custom; efficient practical training combined with an intimate knowledge of the local soils and their possibilities for cropping; and the confident belief in the lavish use of selected artificial fertilisers.

Land Tenure

The system under which land is held is worthy of particular notice, but it is not easy, in a few words, to explain it intelligibly; furthermore, so elastic and far-reaching is its effect that it is said to be impossible to give an adequate definition which would be applicable to all cases.

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In essence, the Custom of the district operates in the following manner. When an area of agricultural land is taken over for market gardening by a tenant an agreed rent is fixed. This is based mainly on the face value of the land for general agricultural purposes ; thus it may vary from, say, £2 10s. to £4 per acre per annum. After the agreement is signed the interest of the landlord ceases, excepting with respect to receiving the rent as it falls due. The tenant now becomes the virtual owner in so far that he can develop it culturally in any way he thinks fit. He can grow market-garden crops, plant temporary or permanent fruits, or otherwise adapt the holding to his immediate or future requirements. It must be admitted that such an arrangement offers to a progressive tenant admirable scope, as it means that the landlord's permission has not to be obtained before an improvement can be instituted.

Assuming, after the lapse of years, the tenant desires to leave his holding, he proceeds to find a successor ; this is never difficult if the land has been well maintained and is in good condition—healthy crops and free from weeds. Proper notice must, of course, be given to the landlord to whom the holder introduces the prospective new tenant. The landlord can object to the person nominated, but this is of rare occurrence.

In the meantime, the out-goer has come to terms with the ingoer as to the sum of money to be paid to him for the holding as it stands ; in other words, the new tenant pays his predecessor for the improvements. Thus, the right of the quitting tenant to receive the just reward for his labour and expenditure incurred in developing the holding during his years of tenure is acknowledged as a matter of equity under the Evesham Custom.

A change of tenancy can be effected at any time of the year. The new tenant is now under obligation to pay rent to the landlord and he can pursue the lines of development most suitable to the purpose he has in view. He can plant further trees, or cut down and remove existing trees, without the necessity of obtaining permission from the owner.

Such freedom of action has had much to do with the rise and extension of market-gardening in the Evesham district. Occupiers of holdings have been able to look to the future with confidence and one advantage of the established Custom lies in the disadvantage to the sitting tenant if he becomes slack and neglectful during the last year or so before leaving.

Soil Variations

The soils are very variable and, naturally, influence the cropping ; it would need a map to indicate properly their nature and distribution.

Near the river Avon, which flows through the middle of this region, light land predominates, and there is a gradation from gravelly to almost sandy loams. These soils are partly derived from

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river deposits, but northern drift has been responsible for pebbles which in places are abundant. They are usually deficient in carbonate of lime.

On the south side of the Avon, but mainly at some distance from its banks, a heavy soil type is encountered, the base being Lias clay with some Cotswold material here and there; analyses of certain fields have shown nearly 10 per cent. of carbonate of lime.

On the northern side the heavy soils (Lias clay) usually contain a much smaller percentage of carbonate of lime and may even be very low in this constituent.

Effect of Soil on Cropping and Cultivation

Visitors to the area are always struck by the extensive fruit plantations and, in April, when the trees are in flower, the predominance of plums is in evidence. The chief variety is the Pershore, or Yellow Egg, but many others are represented, such as Victoria, Czar, Belle de Louvain, Early Prolific, Monarch, Purple Pershore, and Pond's seedling. Plums are grown everywhere. At one time the system of planting in single rows, spaced one or two chains apart, was greatly favoured, as the trees provided shelter to crops grown between; but now that winter spraying is a necessity the block system of planting is universal.

Apples and pears occur to a small extent. Gooseberries have decreased considerably during the last fifteen years. Strawberries are grown on a small scale. Black currants have become popular. Raspberries and loganberries are on the increase.

As regards vegetable cultivation, the heavy and light soils show a sharp distinction. Spring cabbage are not grown on the former, obviously for the reasons that the crop would not mature till late in the season and surface working in the critical months, February and March, is not admissible. Asparagus, on the other hand, is an important crop on the heavy soils, but is now unknown on the light soils; attempts to establish it were made years ago but were unsuccessful.

Labour

The application of mechanization, or power cultivation, to the small holdings is entirely out of the question. On the heavy land it is essential to turn the soil over in winter and give it every chance to weather before March and April. Digging when the soil is wet in the depth of winter does not matter, but anything in the nature of heavy machinery travelling over the surface is not practicable. For this reason the two-tined fork is universally used and it is an education for anyone to watch the skilful manipulation of this simple tool. Throughout the winter months digging constitutes the chief work, and it provides employment for the men. Even on the light land there is little scope for heavy implements; the capital expenditure on such equipment for these small holdings would be unprofitable.

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It will be a thousand pities if economic conditions undermine the stability of the smallholders of the Evesham district. There is no more pleasing sight than to see men (and women) in almost every field through many months of the year. If mechanization has to be adopted of necessity in the production of market-garden crops, it will mean further extensive rural depopulation and the driving out of existence of a hard-working and extremely worthy class of skilled cultivator.

Parties visiting the Evesham district are always surprised at the almost meticulous care taken in keeping the land clean. In certain localities the occurrence of scattered weeds, such as would pass unnoticed on a farm, is regarded with abhorrence ; and astonishment has often been expressed when an asparagus grower has been seen in summer removing the few weeds by hand and taking them away in a hamper to be burnt.

Seed-saving

Evesham growers are justly proud of their types of spring cabbage and Brussels sprouts. These have been raised through many years of rigorous plant selection. The chief reason why this has been undertaken was due to the fault of seed merchants in the past who had not laid themselves out to supply the requirements of the market-gardeners.

Strains of these two vegetables are not known under special designation, but the surnames of the growers identify the raisers.

The type of spring cabbage favoured may be described as rather leggy, early, and turning in (hearting) as it grows. It is essential to clear the ground in good time so that the next crop (usually Brussels sprouts) may be planted as soon as possible—April or early May.

The kind of Brussels sprout selected varies according to opinion, and is dependent on size (large or medium) and colour. For some of the heavy soils a very dwarf, compact type is popular ; it grows very rapidly, and is usually cleared by the end of the year ; the ground is then dug immediately for weathering.

Manuring

Experience is a wise teacher ! Most of us have been brought up on the mineral theory of manuring which, while recognising the existence of various organic fertilisers, regards them as not being of economic utility in field cultivation. Although such a view may be justified, in so far as general farming is concerned, there are reasons why it is not always correctly applicable to intensive market-gardening.

In the Evesham district, on hundreds of acres, no live-stock are kept ; in other words, farmyard and stable manures may be said to be non-existent, and neither are such manures purchased. When it is remembered that there is very little organic matter in the nature of crop residues to turn under, the question of the continuance of

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suitable mechanical soil conditions becomes of paramount importance. That these are effectively maintained can be seen by even a casual inspection of the crops at any time of the year.

In this connection, a distinction must be made between the two main soil types and their influence on cropping. Space permits short reference only to the light soils, where spring cabbage is extensively grown.

Spring cabbage in market-gardening is equivalent to the root-crop in farming ; it is the first crop of the variable rotation and is, therefore, liberally manured. Stable manure if procurable would be costly to purchase, cart and apply, and for these reasons only the wisdom of using it at all is open to doubt on economic grounds. Some suitable form of artificial fertiliser, with a high nitrogen content, is, therefore a necessity ; sulphate of ammonia, nitrate of soda, etc., are admittedly unsuitable for partially-rooted plants so late in the year as September ; the rapid availability of the nitrogen and the type of growth induced by these mineral fertilisers entirely rules them out for application to leafy crops which have to stand the winter. By elimination, the choice of the principal dressing lies among certain forms of bulky organic manures, such as crushed hoof, meat and bone, fish manure and shoddy.

There is a prevalent opinion, derived principally from test-books on fertilisers, that the above-mentioned manures are slow-acting, but such is entirely incorrect. In 1925, Demonstration Plots were commenced at the County Experimental Station with the object of testing manurial methods in vogue in the Evesham district. The relatively rapid action of the organic manures selected has been clearly shown on spring cabbage during the months of September and October. Moreover, the nature of the stimulus is ideal for this class of crop, both stem and leaf developing uniformly and in such a manner as to confer hardihood upon the plants so that they are able to withstand a fairly severe winter. In the new year, they rapidly respond to mineral nitrogenous fertilisers and are ready to cut some considerable time before those differently manured ; for example, with farmyard manure.

Heavy dressings of organic manures (up to one ton of crushed hoof, meat and bone, or fish manure, or two tons of shoddy) are commonly used as the pre-planting application, with or without phosphates and potash.

Succeeding crops (often Brussels sprouts followed by dwarf beans or peas) receive much lighter dressings of other fertilisers ; for these, manurial applications are designed to supplement residues from the spring cabbage.

The Demonstration Scheme at the County Experimental Station is now in the fourth rotation and it is proposed to publish a review of the results in the August number of the *Worcestershire County Council Quarterly Agricultural Chronicle.*

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DISCUSSION

H. V. TAYLOR (Ministry of Agriculture).—When this Research Station was established by Sir John Bennet Lawes and Sir Joseph Gilbert in the last century neither had any vision that one day the Station would be discussing horticultural problems and calling a Conference at which papers would be read on horticultural matters. Rothamsted, in its development, has concerned itself with soils and manures for the primary agricultural crops, wheat, barley, sugar beet, etc. and is now generally regarded as a Station for agricultural problems.

The horticultural industry is much younger than the agricultural industry and perhaps more progressive. It has provided such a host of problems calling for quick solution that it has been necessary to equip this industry with special research stations—Long Ashton Research Station and East Malling Research Station for fruit; the Cambridge Horticultural Research Station for vegetables, the Cheshunt Research Station for glasshouse crops; and the Campden Research Station for fruit and vegetable preservation. These Stations are working on the problems of horticulture and are deserving of whatever support the industry can give both at present and in the future.

Rothamsted, too, is helping the horticultural industry with its fundamental researches on soils, manures and plant pests and its work should be studied by all who raise crops from the soil.

In response to an invitation by Sir John Russell, I read a paper at a Conference held at Rothamsted in 1930 on "The Farm for Market Garden Crops." The chief object of that article was to show that bad times in agriculture were causing farmers in some measure to turn away from cereal and root production and to embrace that of fruits and vegetables and I sought to give some words of advice on a course so beset with pitfalls. Since then the times for the farmer have gone from bad to worse so the change over to vegetable crops has continued though the change was of a less degree in 1932 because wheat growing had again become attractive.

Confirmation for this is to be found in the Agricultural Returns for 1932, which show the acreage under crops on holdings above one acre in England and Wales as returned by occupiers on the 4th June, 1932. The acreage of wheat and sugar beet shows a large increase on that returned in 1931, but the acreage to barley, oats, rye, mixed corn, dried peas, roots, mangolds and swedes are all down.

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Much extra land went down to potatoes, broad beans, cauliflowers, carrots, onions, celery and rhubarb. The increase in acreage over that of 1931 to these crops is as follows :

Potatoes	56,900	acres
Green beans ..	1,200	,,
Green peas	3,300	,,
Cauliflowers.. ..	1,800	,,
Carrots	3,100	,,
Onions	400	,,
Celery	400	,,
Rhubarb	500	,,
	10,700	,,

Similar changes have occurred in other years.

Between 1922 and 1932, for instance, *no less an acreage than* 45,000 *acres have passed over from farm crops to vegetable production* (see page 5). Those accustomed to think of acreage in terms of agriculture may not be much impressed by this figure ; but crops in horticulture are heavy so that the extra food produced is substantial.

In terms of percentage it means that *the acreage to the crops mentioned has been increased by* 31 *per cent.* The acreage has been greatest in the crops of easy production—peas, cabbage, Brussels sprouts and cauliflowers ; the percentage increases of which have been peas 20 per cent., cabbage 18 per cent., Brussels sprouts, 124 per cent., cauliflower and broccoli, 70 per cent.

The supply of vegetables from the farms now such as that of Mr. Joice, has reached such a volume that the old time market gardener can no longer claim a monopoly ; indeed he, too, has to make changes in vegetable production as he once knew it, or retire from it.

High Cost in Market Gardening

Land used for market gardening is, as Mr. Wallace has shown, usually highly rented ; the manures are all bought and the workers paid wages higher than the standard wage of agricultural workers. Even for income-tax purposes the market gardener is treated more harshly than the farmer. The market gardener relies on much hard work : spade digging, hand planting and hoeing, so that it is a small wonder that his cost of production would be higher than the cost of production on farm land, machine tilled, and manured with home-produced dung and where the wages paid were at the standard rate. Mr. Joice's remarks fully confirm this.

Where the markets are not able to absorb all the produce that of the market gardener can only be used for manuring the land : whereas the farmer, as Mr. Joice explains, feeds his sheep on the cabbages, Brussels sprouts or carrot crops. The position is that farmers, such as Mr. Joice, can produce many vegetables and sell them at a lower price than the old established market gardener.

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The advent of the farmer as a vegetable grower is creating quite a situation in the market gardening industry and like other situations, this one also has to be met.

Changes in the Market Gardening Industry

A. *Intensification.*—There are about 46 or 47 vegetable crops and often 20 or so are grown on any market garden. The market gardener produces daily supplies of some kind of vegetable the year over so that it is a matter of no difficulty for him to adjust his programme of cropping so that the acreage to the unprofitable vegetables is curtailed and that of the profitable increased. Such changes are in progress. Many market gardeners are discarding the easy to grow vegetables—peas, cabbages and Brussels sprouts—and increasing their acreages to the finer vegetable crops (asparagus, seakale, early forced carrots and cauliflowers) and salad crops of all kinds. In short, the reaction of this type of market gardener is to greater intensification.

I think this is the direction that will have to be taken by the smallholders of Bedfordshire if they are to remain vegetable growers or they may be crowded out. Mr. Dallas has shown that the acreage to carrots has declined 40 per cent. in the past twenty years. Mr. Dallas said that once there was a tremendous trade in early bunched carrots in June and July but this is practically non existent. Actually the people of England are eating more and more bunched carrots than ever but the carrots are mainly glass frame grown in other countries (France and Holland). Greater intensification in production is needed to win this trade back and it can be done.

Mr. Dallas also refers to the loss of trade in pickling onions and outdoor grown *cucumbers*. By intensification or rather by greater specialisation that trade alone can be won back. The factories no longer pickle just any silver skin onion or any outdoor cucumber as they once did ; but they use only special stocks of onions and cucumbers that give pickles of the most pleasing appearance. The pickle trade is of even greater volume than formerly but it has become very specialised indeed. The onions must be snow white (not smoky) and the outdoor cucumbers must be very small gherkins. If our growers specialise in the production of these the trade can be won back.

B. *Mechanization.*—Other market gardeners attempt to produce peas, cabbage, Brussels sprouts, etc., but attempt to lessen the cost of production of these by replacing hand methods with machinery. Hand digging, hand planting and hand hoeing are giving way to tractor drawn ploughs and cultivators and planting machines so that hand methods are restricted almost to harvesting the crop. Mr. Joice has already shown you how he uses machinery to lessen the cost. To see mechanization carried to its fullest degree in vegetable production one has to turn to the large Lincolnshire farms where vegetables are being grown *on contract* for the canning factories. The contracts are made for the crops produced on many acres at an

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agreed price per ton. The farmer makes his profit by reducing the cost of production per ton. This has supplied the stimulus.

Only this summer I saw on one farm 700 acres of peas all grown for green peas for the factories. Every single operation was done by machinery. Ploughing, drilling, hoeing are easily done ; but on one farm the green pea haulms were mown down, piled on small trucks on a light railway and hauled to threshing machines which threshed out and separated the green peas from the haulm and pods.

This mechanization of production and harvesting was so perfect that the farmer could make a profit though he received but £18 per ton for the *shelled green peas*. By turning our brains to peas the costs of production have been brought down and the canning industry are now able to use the crop of from 3,000 to 4,000 acres.

If the same study were given to, and the same mechanization applied, success awaits with other crops. Take asparagus, most of our canned asparagus, 18,000 cwts. annually—comes from America and the English canning factories assure us they could use the produce of 1,000 acres of asparagus if it could be purchased at about 7d. per lb. The English growers say it cannot be produced at that figure mainly because the methods of production are hand methods. In the great plains of Sacramento all the cultural operations, earthing up, etc. are done with tractors and hand methods are limited to cutting. This asparagus is produced at less cost than the English.

D. R. Bomford (Evesham).—Mechanical developments in ordinary farming practice must necessarily affect market gardening, to the extent of bringing all cultivations undertaken before planting, and inter-row cultivations after planting, within the scope of machinery. This has been happening for several years and machines have proved their superiority to older methods in almost every respect, where the areas in question were sufficiently large.

To these developments have been added two types of machinery capable of doing (*a*) plant setting ; and (*b*) inter-plant cultivation as opposed to inter-row cultivation ; that is, (*a*) the work hitherto done by the peg, dibber, or setting pin ; and (*b*) the hand hoe. Thus in addition to all the ordinary conquests of the machine, the two last strongholds of manual labour in extensive agriculture are assailed.

It is unfortunate that in our present state of development the use of machinery in production should achieve such rapid progress, while the science of economics, on the progress of which the distribution of the wealth produced depends, is allowed to lag behind unnoted ; and in fact, to follow at its own slow speed. In this great and sudden increase in the potential output per man among land workers, we have a typical example of a change which may well produce economic confusion.

Corn production in this country has come to a point at which it is possible for each regular employee to produce as much as 150 tons of wheat per annum. Market gardening is moving in the same

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direction and it is well worth speculating as to what the economic outcome is likely to be.

In the first place anxiety must be felt with regard to the already hard pressed smallholder. No argument is required to establish the fact that his economic suppression would be a national disaster. Yet already hard pressed, what can he hope for? unless engineers will turn their attention far more to the making of ploughing, cultivating, planting and hoeing machines, that can be used advantageously on a small scale, and manipulated by not more than two or three persons at the most. It is true some machines do exist, but in the opinion of the writer they are quite inadequate to the smallholder's general needs.

Secondly, what is likely to be the lot of many of the employees of farmers and market gardeners particularly the slower and less adaptable among them, to whom the statutory wage is already tending to become a disadvantage?

Unfortunately the problem is as much or even more, one of distribution than of production. During the last few years we have seen potatoes so valueless wholesale, that they have been fed to cattle, and even left to rot in the bury. Cabbage ploughed in—sprouts—strawberries and other crops unpicked—so called over-production. Yet there has never been a time when some of those in the great consuming centres have not been hungry.

As the producing cost decreases, so does the distributing cost become large as a proportion of the price paid by the consumer. Already it costs, in some cases, more to distribute a food than to produce it. One comes, therefore, to a point at which reduction in production costs, without a corresponding reduction in other costs, is almost useless as a means of increasing consumption, and the grower in spite of all his efforts pays the severe penalty of so called over production, which would be better described as a failure of distribution. This problem we all recognise as being the stumbling block of nearly every industry to-day, and we also know that it is largely connected with the failure of our currencies to perform their function. The problem as applied to market gardening, however, has a special aspect, in that in this case it is particularly easy for the producer to receive nothing, while the consumer is still paying a relatively high price for the product.

Now as regards non-perishables such as potatoes, parsnips, carrots, artichokes, apples, turnips, etc., the problem does not appear to be insolvable if the producer can be educated into selling by the hundredweight as well as by the ton, and the consumer into buying by the hundredweight instead of by the pound. This would leave the harrassed and hard worked distributor more free to cope with the very difficult problem of the distribution of perishables, such as greenstuff and soft fruit. It may be pointed out that the perishables are all in the nature of luxuries and for such consumers can afford to pay highly; on the other hand, the one hope of avoiding unemployment in a market gardening industry in which potential

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output per man is greatly increased, lies in creating conditions under which all are consumers of luxuries as well as necessities, and the only control the producer and distributor have over such conditions is by offering to the consumer at such a price, that the low wage earner can buy. In the case of the perishable it is easier to point to the necessity of the solution than to find it.

Generally speaking, there would appear to be two types of buyers. One will go to a highly decorative shop in a fashionable street ; in this case every Brussels sprout which leaves the shop has had to pay high rates, rents, management, ornamental and other charges. The other will go to an unpretentious shop where, in spite of low overhead charges, the turnover is so small as to make these charges excessive per pound sold. In the small shop particularly, the probability of a perishable residue is always liable to force the retailer to charge an additional sum on sold perishables to cover the loss on unsold ones. Is it beyond our ingenuity and enterprise to bring the efficiency and high turnover of the first type of shop, to large scale unpretentious buildings built where rent and rates are low, and to attract both types of customer to it, by sheer force of offering a good foodstuff at an attractive price ?

Secondly, it may be possible that the canning process will help to solve the problem of the disposal of an excess of perishable vegetables.

These are only small steps towards the solution of a pressing problem, which if we are to avoid disaster in the production personnel of the industry, call for the immediate and careful consideration of producer, distributor and consumer alike.

H. Goude, N.D.H. (Norfolk).—Mr. H. Goude, speaking during the afternoon session, said he had listened with very great interest to the points raised by the preceding speakers. If we viewed vegetable production from a national standpoint we would not fail to observe that the bulky vegetable crops were grown either near to the large centres of population, or in districts with easy facilities for transporting the crops to the markets. The only exceptions to this rule were specially favoured districts for early produce, as Penzance for broccoli, and our marshland district in Norfolk for spring cabbages, or other eminently suitable areas for the production of specialised crops. As far as Norfolk is concerned, the recent developments have been on the lines explained by Mr. Joice. Norfolk farmers have always grown vegetable crops for a possible market. If the price was satisfactory, the crop was sold. If no market was available, the crop would be fed to farm stock. With the loss of markets for farm crops in recent years, there has been a decided increase in vegetable crops grown on farms. The chief crops selected are carrots, savoy cabbage, Brussels sprouts, spring cabbage and broccoli. These crops are easily produced, and for that reason are selected by farmers who risk a few acres with these vegetables for a possible market.

As a county officer, responsible for advisory services in vegetable production, I have always pointed out the possibility of loss from

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this form of cultivation. During a severe winter, Norfolk vegetables are in demand, as vegetation is seldom severely injured by continued hard frost in the county. In a severe frost I have seen the sprouts and savoy crops sere and brown in Bedfordshire and Worcestershire, while our crops were still green and marketable. Vegetable crops are more profitable in Norfolk during severe winters.

The farms near the canning factories have reaped considerable benefit from the cultivation of green peas; about 1,000 acres are under this crop, which is grown on contract. The main varieties are Alaska and Lincoln. We also grow a large acreage of celery, mainly on the fen-lands; also beetroot and dwarf beans. The demand for these crops by canning interests is increasing. As we have eminently suitable soil for asparagus and seakale culture, the large-scale production of these crops is now proceeding, and is likely to develop into a considerable industry as the crops are in demand by canners.

The recent developments in production are the general utilisation of mechanical means for soil working and planting. Most of the brassica crops are seeded on the land where they are to mature, and planting is only employed to make good any failures in the plant. These large-scale and cheaper methods of production of vegetable crops have developed outside our regular market gardening districts. The smallholders and regular market gardeners have not been unduly pressed by competition from this source in our local markets, but there is the general tendency for the smaller cultivators to increase their fruit lands and also to erect glasshouses and frames for the intensive production of fruit, vegetables and flowers.

In several districts it is possible for smaller cultivators to hire tractors for ploughing and cultivation, at reasonable terms, and the ownership of small tractors for cultivation, is increasing among smallholders. Further developments on these lines place the smallholder in a more favourable position with productive costs when compared with the larger cultivator, and when he specialises in crops requiring higher skill and experience his position is as firm as the larger producer.

We can improve the demand for vegetables if we induce the cooks to prepare vegetables in a more appetising manner for the table. It is rare to have any properly cooked and served vegetables in hotels and restaurants.

Most of the papers and speakers referred to the decline of available supplies of manures.

The solution to the manuring problem is the development of pig-keeping. At our Burlingham Horticultural Station we have designed pig-sheds and trough yards expressly for the purpose of making the largest quantity of manure from each pig kept, and the results in manure-making have been quite satisfactory. We estimate that we make two loads of valuable manure from each pig fatted. This is done by littering the yards with straw and any vegetable refuse from crops grown on the Station. When this manure is made, it is run from the yards on to the land, and used for top dressing bush

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fruits, vegetable crops, and wherever it is required. This form of manuring is then supplemented with inorganic fertilizers, and thus the land is maintained in a high state of fertility. We think that pig-keeping is so intimately connected with high soil fertility that I would propose that this Conference sends a resolution to Councils, Committees and Associations responsible for the national organisation of the Pig Industry to accelerate their work in order that all the pork and bacon required by this country is produced here. This would save at least £50,000,000 per annum, would relieve rural unemployment, and make it possible for the economic production of all vegetable crops and also bush fruit crops of improved quality.

W. F. CHEAL, N.D.A. (Wisbech).—In the Isle of Ely little market gardening is carried out. Fruit growing has developed very much on the various types of silt and silt clays of the Wisbech district, and to a small extent on the southern borders adjoining the Histon—Cottenham area. The remainder of the county is chiefly black fen soil and is devoted to the production of main crop potatoes, sugar beet, and a little corn. Some celery is grown near Peterborough and around Ely.

The use of the motor has been one of the chief factors in the recent developments. As a means of transport it has ensured the delivery of fresh produce to the canneries, and it has brought the Wisbech strawberries within still better reach of the midland and northern markets *. This year supplies of strawberries have been sent by road to preserving works and canneries as far afield as Slough.

The smaller types of motor tractor promise to solve the difficulty of expense incurred in digging and cultivating the fruit plantations (gardens). For pest control and spraying purposes the motor pump is indispensable.

The dwindling supply of horse manure from the large towns has been caused by the introduction of motor transport. This is a big disadvantage, for the supply of humus to the lighter silt soils N.N.W. of Wisbech is important. Green manuring is sometimes adopted, and it is a very sound practice as a preparation for strawberries and potatoes.

Of the new systems of farming introduced around Wisbech as the result of the depression of the 'eighties, the production of the large-size cooking apple has held its own, and in view of the probable competition with market garden crops grown by farmers in other districts following the depression of recent years, it appears as if the cooking apple will continue to remain the best product of the Wisbech grower for some years to come.

W. CORBETT (Kent).—Much has been said about the mechanization of market gardening and the reduction of production costs in

* In the Research Monograph No. 6, "A Survey of the Soils and Fruit of the Wisbech Area" we read (p. 25) "coming from Kent to be nearer the best markets which he found were in the Midlands and the North, Mr. Bath took land at Wisbech, hiring the Osborne Farm of 150 acres."

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this way. A great deal can be done by mechanical aids, but there is a real danger of mechanization being taken too far ; the result of this might be that the land, originally clean, will become dirty, and weeds will become very serious competitors with the crop. In the cultivation of all market garden crops hand labour for cleaning the crops is indispensable, especially in the case of crops which are planted or sown at short distances.

In the industry to-day there is a dual tendency—first, to become less intensive, and second, to become more intensive. In the latter case, the change of fiscal policy of this country is bound to have a far-reaching effect, but how far may depend on how soon the growers can adopt the methods now being used in Holland and France. The growers obviously will not invest capital in the necessary equipment for carrying out this intensive culture until they are reasonably certain of success in the management and the financial result of such an undertaking. Much could be done by the Agricultural Education authorities in the various counties to help growers in this matter, especially by demonstrating the best methods.

In the future, electricity may play an important part in these intensive methods of vegetable production. With the present shortage of manure for making hotbeds, the Norwegian system of electric hotbeds may in the near future become a practical proposition.

Many problems connected with the market garden industry are awaiting the research worker, and of these the more important are the practical control of certain diseases and pests which take a yearly toll of certain crops, and a classification of vegetable varieties that will help to do away with the confusion which arises from the innumerable synonyms with which we have to contend at present.

F. A. SECRETT (Surrey) : Vegetable growers in the Home Counties have for some years realised that many of the crops which paid their forebears to produce have ceased to be a commercial proposition, and it has become a usual practice with growers who keep accounts to eliminate any crop which does not pay after a period of five years. Unfortunately, changes of methods in horticulture, invariably call for more capital, and with such a hazardous business as vegetable growing has been in the past, many have been chary of sinking capital in their businesses. The advent of tariffs on foreign produce has rather altered the position, and it is the duty of all of us engaged in the growing industry to-day to supply the goods where our climate and soil permit, which have in the past come from abroad. There are a few growers who for a number of years have been endeavouring to compete with the foreigners ; some have been successful, others have had to give up, largely because they contracted out for so much of their work such as transports, manure contracts and selling ; consequently, even with the present tariffs, the profits are very small. The old returnable crate which after a few journeys becomes a dirty and untidy package, has got to go, and whether we like it or no, I

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consider we shall all be forced to pack our best grades of vegetables in clean non-returnable crates.

At the Conference we heard a good deal of the mechanization of farms. This may be well on farms extending to 200 acres and over, but the smaller the vegetable farm the more intensive the work and the more hand labour required. We are told to-day to copy the foreigner. One sees very few machines of any sort on Dutch or French vegetable holdings, and this largely accounts for the high grade of their produce. The production of such crops as lettuce, carrots, cauliflowers, turnips, marrows, etc., etc., under glass, whether in cold frames or cloches, can only be done with hand labour and had we more of these holdings in this country, instead of men being driven off the land by machines, we should be continually drawing fresh labour into our villages.

In regard to salad and other crops, the grower to-day must work for the early and late season. For this purpose he must have plenty of lights and cloches. The standard Dutch light which can be purchased in this country to-day at 3s. 10½d., is, in my opinion, the best light to use. The French light is also good : the framework of the French light is made of 2 ins. by 2 ins. timber with three small T irons which act as sash bars. The low barn type of continuous cloche is very quick in its work and is the best of all the continuous cloches. The expenses for repairs on the French light are heavier than the Dutch.

To state briefly, the following methods are those that can be employed in the cultivation of salad, and other crops under glass. The main crops are lettuce, carrots, cauliflowers, turnips, and marrows. The Lettuce are sown in lights fairly thickly from the 10th to 25th October. For cold frame work the best variety is " May Queen " for greenhouse or hot bed " Gotte à forcer " or " Loos Tennis Ball." Sowings are made every three days. As soon as the seedlings are large enough to handle they are transplanted into cold frames 1½ ins. to 2 ins. apart. The soil in these frames must be well prepared and a little well broken down manure spread over the top and forked in. This must not be fresh, but thoroughly well decayed and fairly dry, in fact, almost in the condition of dust. The lights should be kept closed until the seedlings have made fresh root and then should be aired back and front in mild weather, only shutting down in severe frost. If the frost is very severe the lights should be covered with litter or mats.

Cauliflower plants can also be raised by the same methods. These should be sown on the 12th of September and pricked out in the same way as the lettuce. Plenty of air should be given to the plants, the lights being removed on fine days. In both cases the plants must not receive any rain or be watered. As soon as the days begin to lengthen (about the 15th January) permanent beds should be erected. The soil must be in a friable condition containing a fair amount of humus and moisture.

The first crop to be sown in the beds is carrots. These are sown

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broadcast, care being taken to sow thinly. Any good forcing varieties are suitable, such as Demi Long à forcer, etc., etc. The lettuce are then planted 9 ins. to 10 ins. apart and the lights are put on and kept shut down. It is not necessary to air the lights until the lettuce are almost ready to cut. When the lettuce are ready to cut four cauliflowers are planted in each light, two at the top and two at the bottom. As soon as the lettuce are marketed the cauliflowers and carrots will require water and this must be done by overhead irrigation. Water must not be slopped on with a hose pipe. The lights from now on must be given as much air as possible, and as soon as the young cauliflowers begin to touch the glass the lights should be removed. If any form of heat is used turnips also may be sown in the lights. The lights from now on can either be used to erect greenhouses as in Holland, or they can be placed over young marrow plants which have been sown about the 1st February, in this way marrows are obtainable when very high prices rule in the market.

Downy Mildew is the chief disease to watch against in the lettuce beds. Loos Tennis Ball has been found a good variety to withstand this disease, but for hot beds Gotte à forcer is to be recommended. A good variety for cold beds is May Queen.

As a final word in regard to salad produce. It is advisable to work for the early and late seasons, as during the time that small fruit is in, lettuce is usually a glut.

H. Hickman (Wisbech).—In the few minutes at my disposal I wish to make some remarks regarding the canning industry from the growers point of view. While not underestimating the influence the canning industry will have on the fruit-grower, we must not lose sight of the fact that as far as fruit is concerned the jam industry takes a far heavier tonnage of the soft fruit. It is of no use to the country to start a fresh industry unless we take steps to preserve one which we have already made, and which during the last few years has been hurt by the importation of fruit in pulp at excessively low prices with which we cannot compete. The combined industries, in both are successfully carried on with English fruit, will have a far reaching effect on the future of British fruit growing.

If canners in a year of plenty can see their way to put down more than their ordinary requirements in anticipating the shortage which the next season invariably brings, they will help the fruit growing industry considerably. With regard to pickles, I have unfortunately lived long enough to remember the time when the whole of the cauliflower and a large portion of the onions used in pickles were grown in England, but now the Dutch and French, with their lower cost of production, and lower standard of living have unfortunately beaten us, but with the tariff in view, we shall hope to regain the business we once had, and we ourselves made.

In conclusion, I regret to hear some of the speakers dwelling so much on mechanization of the industry. We all use tractors but when it comes to the picking of our fruit crops machines are of very

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little use and the great hope for the future prosperity of England is to have a virile agricultural population and it is my earnest hope we shall achieve this in the near future.

MESSRS. SUTTON AND SONS (Reading).—Seed growers have done more than anyone in raising and developing new and improved strains of vegetables.

It has been stated that the only variety of dwarf bean suitable for canning is the Refugee, seed of which is not produced in this country. It may, however, be of interest to state that this variety was offered in our catalogue over fifty years ago, but was discontinued because it was superseded for *culinary purposes* by many better varieties. There were no canning factories in this country to need it in those days.

It is difficult for those who are not constantly working on the raising of new varieties to realise the amount of care and thought which is expended in the process. Potatoes, roses, dahlias and fruit trees are quite in a different category to vegetables, for they are propagated by roots, bulbs, grafts or cuttings, and are really the parent plant perpetuated. Seeds are a new generation, produced by pollination, and whilst generally the progeny of a plant will be like the parental form, there is no certainty that every plant will be identical. Successive generations of a variety often vary from the original, according to the ideas of the seed-grower or person selecting, whilst the tendency to degeneration in all, and the possibility of cross-fertilisation in many, accounts for the variation which is sometimes to be found in crops grown from seed. Seed merchants with a reputation to uphold do their utmost to keep their seed crops as true to type and as perfect as possible, and nothing that they or any other organised body can do with trials or selections will make it possible to guarantee that plants produced by seed will always be 100 per cent. perfect and precisely identical with the parental form.

HARRISON AND SONS (Leicester).—The recent developments in market gardening have extended to farmers whose acquaintance with the varieties and character of vegetables is not extensive. To the farmer now taking up this department, a word of warning may not be out of place: High quality seeds which are a necessity cannot be produced cheaply, nor does it follow that the most expensive will suit his soil, and his purpose. He has therefore much to learn in what is to him a new business, and he should act with the utmost caution and be guided by those of experience—growers and seedsmen alike.

It should be noted that the market requires supplies of well-grown vegetables, even in character, and just at perfection, and for these will pay the best price. For this purpose, special stocks must be selected, so that the crop matures well and evenly, with as few discards as possible. In this respect stocks differ from those preferred by the ordinary private gardener who requires one crop to supply small lots over a long season.

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The production of seeds for the market grower is a specialized one, and is confined to a limited number of seedsmen. It is different from the production of potatoes (except from seed—not sets). Potato reproduction is definitely from the tuber, and cannot be changed by any method. Seeds are the result of fertilization, and in consequence, are liable to great variation of character and strain.

Whilst this gives a very desirable scope for selection, it also makes an enormous number of varieties and names, and because many are selecting according to their own ideas and fancies, as well as the suitability or otherwise of the varying soils and climatic conditions, names have been bestowed all too generously.

There are many more pitfalls in connection with vegetables than with farm roots, and where possible, farmers interested should accept the opportunity of visiting seedsmen's trial grounds in order to select such varieties and strains which are likely to suit his market, as well as his soil and climatic situation.

The best prices are given for crops out of season, but only experience will teach one how safely to get that result. In this endeavour great caution is necessary. The serious seed merchant is just as anxious to supply the best and most suitable article, and he spends much time and money in testing and purifying stocks, as well as trying to produce better ones.

It is acknowledged that the British seed grower and raiser stands as high in the world's estimation as does the live stock breeder.

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